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Claremont McKenna College

An Econometrics Analysis of Mark Rothko's Auction Results

submitted to

Professor Yaron Raviv

by

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for

Senior Thesis

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Abstract

This paper investigates the factors that influence hammer price in fine art auctions. Unlike previous studies, this thesis focuses solely on Mark Rothko's abstract painting auction results, which eliminates pricing variation from multiple artists or painting genres. Using a freshly constructed database that covers all Rothko auction records from 1985 to 2017, this thesis affirms the presence of declining price anomaly. Auction house experts' pre-sale estimates are shown to be largely unbiased with a marginal downward pricing tendency. Furthermore, size is a statistically significant variable that affects hammer price and Rothko's vertical compositions are favored in the auction market.

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Furthermore, I'd like to acknowledge my internship experience with the Fine Arts team at Sotheby's Hong Kong. The insightful and rewarding experience working with auction house experts not only honed my understanding of the art world but also inspired this thesis.

I am forever thankful to the incredible lifelong friendships I have formed throughout my time studying in California and Massachusetts. I truly appreciate our inspiring dinner conversations, spontaneous road trips, and delightful art gallery visits, which have brought me so much joy.

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Introduction

The fascinating and complex nature of the global contemporary art market has captivated growing interest among the public and academia in recent years. The value of art is often opaque as art often is sold in private transactions through art fairs and galleries. However, art auctions are public records that reflects the market's maximum willingness to pay for an artwork. With new auction records regularly getting broken, an increasing important question is what affects the selling price in art auction.

While some claim that the value of art is simply determined by buyer's irrational desire, economists have proposed several factors that may influence hammer price. Currently, there have been numerous studies conducted on the relationship between selling order and hammer price. Meanwhile, some have suggested that the age of the artist when the work was completed is a significant factor that influences the auction result. Moreover, there are some studies that analyze other factors, such as the artist's reputation, medium, and size, regarding their effects on hammer price. However, the underlying complication with the existing research is that their database usually consist of multiple artists and painting genres. For instance, the demand for Cézanne's landscape paintings maybe completely different than his portraitures. Thus, it is difficult to accurately measure the fluctuation in hammer price with these factors involved.

For this thesis, I have chosen to analyze the auction results of Mark Rothko's abstract paintings. As one of the most prominent abstract expressionists and post-war

American artists, Rothko is not only immensely influential in art history but also a record-breaking auction star. Although his early artistic styles blended Expressionism and Surrealism influence, Rothko mostly worked with abstraction throughout his career. Considered as one of the leading figures of the Abstract Expressionism movement, Rothko's was most known for his seminal "multi-forms" in which he depicted a series of rectangular shapes with vibrant, luminous colors. Critics noted these richly colored squares on canvas elicit profound emotion such as ecstasy, tragedy, and doom. His paintings are intended to be viewed at a very close range, as Rothko believed such intimacy can evoke a sense of sublimity and transcendence.

By concentrating on a single artist who worked exclusively with abstract paintings throughout most of his career, my research eliminates the erratic hammer price deviation as a result of artist reputation or subject matter. To investigate what influences Rothko's abstract painting results, I constructed an original database that contains all of his auction records from 1985 to 2017. Using Stata, my regression model analyzes factors that may influence auction price while holding the artist and painting genre constant.

Briefly, the main findings of this thesis are the following. First, the regression model demonstrates the negative relationship between lot number and selling price. This affirms the effect of selling order on hammer price, an anomaly discussed in earlier academic findings. Next, the pre-sale estimates provided by auction house experts are mostly unbiased. Most importantly, this thesis establishes that size is strongly correlated with hammer price and vertically elongated canvases are preferred among Rothko buyers.

The paper is organized as follows: the first section reviews the existing academic debate regarding fine art auction. In the next section, the original dataset and research methodology is described. The summary statistics is then analyzed, followed by the multiple robust regression model. Immediately after, the results discussion is presented along with the conclusion at the end.

Literature Review

With the increasing interest in the art market and auction among economists, there have been many academic papers written on the subject of art auction. Some of these studies revolve around the subject of estimate bias, the age of the artist, and the order of which an artwork is sold.

Ashenfelter (1989) argues that auctioneers provide genuine valuation of an artwork. Louargand and McDaniel (1991) acknowledge this finding with Americana category auctions in New York and therefore argue the market could rely on professional's predictions. However, Bauwens and Ginsburgh (1999) dispute this result by suggesting that auctioneer's prediction is slightly biased. Using a database of 1,600 lots of English silver auction records, they conclude that auction house tend to undervalue more expensive lots. Campos and Barbosa (2009) propose that art expert's opinion is limited in predicting whether a lot would sell or not in auction. Ekelund, Jackson, and Tollison (2013) support the presence of downward bias tendency in pre-sale estimates using the records of eight twentieth-century American artists.

Galenson and Weinberg (2001) investigate how age is related to creativity by classifying artists by those who peak very early and those whose apex late in their careers. Bayer, Page, Raviv, and Rosett (2013) observe the inverted U-shaped relationship between an artist's age and quality of work as reflected in Old Masters

auction prices. Using auction prices from 1786 to 1909 in England, they reveal that the concavity curve of artistic output increases for those with higher native ability.

Many studies have been conducted regarding the declining price anomaly in sequential auctions, or the phenomenon where identical products in sequential sales follow the pattern of diminishing prices. Ashenfelter (1989) notes the enormous price variability from wine auctions data and argues that the decreasing value of homogeneous commodities violates the law of one price. Beggs and Graddy (1997) analyze the relationship between the order of sale in art auctions and the hammer price. Their empirical study on Contemporary Art and Modern & Impressionist Art auctions reveals the presence of “afternoon effect”, or that identical lots sold in auction follow a pattern of decreasing hammer price. Furthermore, the study indicates that the optimal strategy for auctioneers would be place the most valuable item first. See Raviv (2006) for further discussion of the declining price anomaly. In a recent study conducted by Hong, Kremer, Kubik, Mei and Moses (2015), the authors affirm the presence of the anchoring effect, or the tendency for an individual to rely on the initial price in decision making. Their study reveals that when Sotheby’s and Christie’s hold Impressionist and Modern Art auctions, whichever auction house goes first during an auction week would generate significantly more revenue.

This thesis will examine the aforementioned factors that influence auction price. By focusing on a single artist who predominantly worked with abstract paintings, this study differs from existing reviews as it eliminates pricing deviation as a result of an

artist's reputation or subject matter. Furthermore, it provides new insights regarding how size, canvas orientation, and paint medium may influence hammer price for abstract art.

Research Methods

Although some auction houses publish their auction records online, such information is often incomplete and there is no aggregate dataset available for this project. Therefore, I constructed my dataset using information provided by Artprice, a leading online fine art database frequently used by art industry professionals. The Artprice search engine provides past auction results including information such as title, hammer price, lot number, image, pre-sale low and high estimates, size, medium, date of creation, provenance, auction date, location, and auction house. Unfortunately, these records were neither available for download nor suitable for data analysis. Based on the information, each observation is then categorised and manually recorded in appropriate format in the database.

The database covers all of Rothko's abstract painting auction records, ranging from the first computerized auction record in 1985 until the most recent auction in 2017. Notably, some lots were excluded for this project. Bought-in lots, in other words lots failed to sell at auction and remain the property of the consignor, were not included since the hammer price is unobservable. Because the highest bid of the bought-in lot is proprietary information of the auction house, it is impossible to measure the market's maximum willingness to pay for those lots. In addition, several lots featuring unusual medium such as tapestry were excluded. The rationale is that Rothko is known for and worked almost exclusively with abstract paintings. Since the goal of this project is to investigate Rothko's abstract paintings, I omitted a few auction records containing his

early career work featuring figurative paintings, drawings, and watercolors.

Subsequently, reproduction of Rothko's work such as lithograph prints were also excluded.

Several variables were created for this project. Since the low and high pre-sale estimates provided by auction house are highly correlated, I decided to generate a new variable that measures the mean of the estimates called "EstimateMidpoint" to rectify collinearity. Also, the estimate average would be a better metric for regression purpose as the pre-sale estimates often cover a large spread. Another variable titled "ArtistAgeSquared" was created in order to examine concavity effect of the age of the artist on hammer price. The underlying hypothesis is that paintings produced in a particular period in Rothko's career would be sought after by collectors. Furthermore, a variable called "OtherMedium" was defined to represent all mix media works. Although Rothko mostly painted using either oil or acrylic on canvas, he also explored other mix media such as acrylic on paper and board. Therefore, this variable would measure the deviation from his traditional painting technique. Finally, we analyze the effect of the size of the painting on hammer price. The variable "Size", or simply height multiplied by width, was created. In addition, I also generated "SizeSquared" to examine the concavity effect of size - perhaps the auction market would penalize a Rothko painting for being substantially large or petite.

In order to reasonably compare the hammer price over the years, I adjusted the the hammer price for inflation. By using the Consumer Price Index for All Urban Consumers

provided by Federal Reserve Economic Data (FRED), the hammer price in USD is monthly adjusted. The base month is set to be November 2017, which is the most recent month in which a Rothko was auctioned.

Using Stata, I proceeded to analyze the database. Under suspicion of non-constant variance, I ran a Breusch-Pagan test, which yielded a large chi-square value with p-value below the threshold of 0.05. As a result, the null hypothesis of homoscedasticity is rejected and heteroscedasticity is assumed. Therefore, I obtained the model with a multiple linear robust regression.

Data Description & Analysis

Table 1. Summary Statistics

VARIABLES	N	Mean	Std. Dev.	Min	Max
HammerPrice	172	7,981	14,553	25	75,000
AdjHammerPrice	172	9,089	15,730	34.85	83,835
LotNumber	172	42.38	46.98	2	360
LowEstimate	164	4,643	7,764	30	40,000
HighEstimate	164	6,538	11,089	40	60,000
EstimateMidpoint	164	5,590	9,418	35	50,000
SoldBelowLowEstimate	172	0.273	0.447	0	1
SoldAboveHighEstimate	172	0.343	0.476	0	1
YearCompleted	170	1,961	7.277	1,940	1,970
ArtistAge	170	57.55	7.277	37	67
ArtistAgeSquared	170	3,364	819.2	1369	4,489
Oil	172	0.756	0.431	0	1
Acrylic	172	0.233	0.423	0	1
Tempera	172	0.012	0.108	0	1
OnCanvas	172	0.75	0.434	0	1
OnPaper	172	0.494	0.501	0	1
OnBoard	172	0.076	0.265	0	1
OnPanel	172	0.087	0.283	0	1
OtherMedium	172	0.407	0.493	0	1
Heightm	172	1.395	0.662	0.12	2.91
Widthm	172	1.064	0.588	0.19	4.22
Size	172	1.824	1.679	0.0228	11.24
Sizesquared	172	6.132	12.16	0.00052	126.4
AuctionYear	172	2,003	8.777	1,985	2,017
AuctionMonth	172	8.023	3.168	2	12
AuctionDay	172	12.13	5.930	2	30
SoldinUS	172	0.866	0.341	0	1
SoldinUK	172	0.134	0.341	0	1
Sothebys	172	0.494	0.501	0	1
Christies	172	0.483	0.501	0	1
Phillips	172	0.023	0.151	0	1

Table 1 reports the summary statistics. It provides a brief preview of Mark Rothko's auction records. The dataset contains 172 observations of Rothko's abstract paintings offered in auction. Prices are recorded in thousands of U.S. dollars and the most expensive Rothko was knocked down at \$75,000,000. Interestingly, the lowest lot was sold for merely \$25,000. Without adjusting for inflation, the average hammer price is \$7,981,457. After adjusted for inflation in November 2017 dollars, the mean hammer price increases to a little over nine million dollars.

The lot number, which is an identification number assigned in auction, corresponds with the order in which an artwork is sold. Although in some auctions the lot number does not necessarily begin with 1 or occasionally some numbers are skipped, the lot number usually represents the actual selling order. Since there is no data to indicate the actual selling order, I assume that the lot number is the selling order in sequential auction. The mean lot number for Rothko is 43, with a standard deviation of 47.

Pre-sale estimates are auction house experts' opinion about the potential selling range of an artwork. It is based on the examination of the item and information on comparable artwork sold recently. The low estimate and high estimate of each lot is usually published in the auction catalogue, except in the cases of some high value lots where the estimate is provided to potential buyers upon request. As a result, only 164 observations have both low and high estimates. These numbers are pivotal as they signal potential buyers the artwork's preliminary value and therefore influences how many bidders would be interested in a particular lot. The low estimate is particularly important

as it is the basis for establishing the reserve price, which is the confidential minimum price agreed between the auction house and the consigner. If the highest bid fails to meet the reserve price, the artwork would be “bought-in” meaning it is unsold. Conventionally, the reserve price must be set at or below the low estimate. In this dataset, 27.3% of all the Rothko paintings were sold below low estimate, whereas 34.3% of the lots exceeded auction house specialists’ expectation by selling above estimate. This leaves the remaining 38.4% of the lots selling within the low and high estimates.

The variable “YearCompleted” indicates the year in which the artist completed the artwork. “ArtistAge”, a collinear variable created to facilitate the regression model, denotes how old Rothko was when he completed the artwork. Of all the observations, the earliest Rothko painting sold in our data was created in 1940 when he was 37 years old. On the other hand, the latest piece he created was at the end of his career in 1970, when he tragically committed suicide at the age of 67. The mean year of completion is 1961, or when Rothko was 57 years old, with a standard deviation of 7.2 years. It shows that this database mostly contain Rothko’s mid to late career works.

In terms of medium of the artwork, a few binary variables were created such that 0 is false and 1 is true. Variables including “Oil”, “Acrylic”, and “Tempera” denote what kind of paint Rothko used for each painting. Additionally, “OnCanvas”, “OnPaper”, “OnBoard”, “OnPanel” show which medium or texture the work was painted on. Oil on canvas seems to be Rothko’s preferred combination when painting. About 76% of the lots was painted with oil, 23% with acrylic, and 1% with tempera. Similarly, 75% of the lots

used canvas, 50% were painted on paper, 7.6% were made on board, and 8.7% were created on panel. Notably, Rothko occasionally created mix media works such as “oil on paper laid down on canvas” or “acrylic on paper and on panel”. Therefore, the sum of media type may exceed 1.

The dimension of the painting, measured in metric units, is another critical variable worth scrutinizing. The average dimension of Rothko’s painting is at 1.39 meter tall and 1.06 meter wide with a standard deviation of .66 and .59 respectively. The smallest height is recorded at only 0.12 meter whereas the tallest painting is at 2.91 meter. Measuring horizontally, the narrowest painting is only at 0.19 meter whereas the widest is at 4.21 meter. The overall size of the painting also varies dramatically, with a mean size of 1.82 square meter and standard deviation of 1.68 square meter. The smallest painting sold is recorded at 0.023 square meter whereas the largest at 11.2 square meter.

The first recorded Rothko painting was sold in auction in 1985 while the latest was sold in 2017. Interestingly, no Rothko painting was sold in January. The mean auction month of 8 with a standard deviation of 3.2 shows the auction cycle, where major auctions are held in May and November in New York and February, June and October in London annually.

From a geographical standpoint, all the recorded 167 Rothko abstract paintings were sold in either the United States or United Kingdom. Thus, “SoldinUS” and “SoldinUK” are perfectly collinear variables. Almost 87% of the total lots were sold in New York and the remaining 13% in London. Unsurprisingly, New York dominates as

the auction center for Rothko possibly because there is greater demand for Modern & Contemporary art in New York whereas London is traditionally the hub for Old Masters painting.

Finally, it is important to examine which auction house sold the most Rothko. It is reasonable to say that a duopoly exist in the market of auctioning Mark Rothko paintings. Sotheby's draws a tie with Christie's as both sold 49% and 48% of all the Rothkos in the database. Phillips came in third by having a 2.3% share in the Rothko market.

Regression Model & Results

The dependent variable in the model is the adjusted hammer price. The covariates include the lot number, pre-sale estimate midpoint, Rothko's age when he completed the artwork, age squared, artistic media (oil, acrylic, on canvas, on paper, or other medium), height, width, size, size squared, auction year, geographic location (US or UK), and auction house (Sotheby's, Christie's, or Phillips).

$$\begin{aligned} \text{AdjustedHammerPrice} = & \beta_0 + \beta_1 * \text{LotNumber} + \beta_2 * \text{EstimateMidpoint} + \beta_3 * \text{ArtistAge} + \\ & \beta_4 * \text{ArtistAgeSquared} + \beta_5 * \text{Oil} + \beta_6 * \text{Acrylic} + \beta_7 * \text{OnCanvas} + \beta_8 * \text{OnPaper} + \\ & \beta_9 * \text{OtherMedium} + \beta_{10} * \text{Height(meter)} + \beta_{11} * \text{Width(meter)} + \beta_{12} * \text{Size} + \beta_{13} * \text{SizeSquared} \\ & + \beta_{14} * \text{Auction Year} + \beta_{15} * \text{SoldinUS} + \beta_{16} * \text{Sothebys} + \beta_{17} * \text{Christies} + \varepsilon \end{aligned}$$

(where “Oil”, “Acrylic”, “OnCanvas”, “OnPaper”, “SoldinUS”, “Sothebys”, “Christies”
are binary dummy variables)

Table 2. Regression Results

VARIABLES	All Inclusive Model AdjustedHammerPrice	Final Model AdjustedHammerPrice
LotNumber	-7.771* (4.041)	-7.050* (3.826)
EstimateMidpoint	1.166*** (0.174)	1.161*** (0.169)
ArtistAge	-413.3 (858.2)	117.2 (101.7)
ArtistAgeSquared	4.729 (7.914)	
Oil	-1,487 (1,124)	-1,608 (1,044)
Acrylic	-2,702* (1,457)	-2,634** (1,318)
OnCanvas	-629.4 (452.6)	-514.0 (370.5)
OnPaper	-1,735 (1,583)	-1,891 (1,532)
OtherMedium	193.4 (587.1)	127.3 (551.1)
Heightm	-2,029 (3,023)	-1,408 (1,157)
Widthm	-8,618* (4,747)	-8,118** (4,078)
Size	4,411 (3,224)	3,713** (1,453)
SizeSquared	-37.78 (131.5)	
AuctionYear	-44.28 (68.32)	-40.62 (65.94)
SoldinUS	-285.3 (458.7)	-271.8 (417.9)
Sothebys	231.1 (902.2)	307.9 (844.5)
Christies	440.0 (620.0)	426.4 (586.9)
Constant	104,654 (156,054)	82,391 (134,334)
Observations	162	162
R-squared	0.861	0.861

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Discussion

The first column reports the original all inclusive regression model. In this model, there are four statistically significant variables, as indicated by asterisk, which are “LotNumber,” “EstimateMidpoint,” “Acrylic,” and “Width.” However, this result is not consistent with the theoretical prediction that the artist’s age and the canvas size would influence the hammer price.

Under suspicion of multicollinearity, I ran a correlation matrix to identify explanatory variables that are highly correlated with other covariates. And then, I excluded insignificant variables and executed the regression model multiple times until I reached the final model. For instance, I omitted “ArtistAgeSquared” since it is highly correlated with “Artist Age” but neither variable was statistically significant in any models. In other models, I also excluded covariates such as “Acrylic” in lieu of “Oil”, “OnPaper” in lieu of “OnCanvas” but none were statistically significant. The final model, presented in the second column, excludes “ArtistAgeSquared” and “SizeSquared” . It shows that “Size” is also statistically significant in addition to the four variables in the first model.

Finally, I verified if the lack of results was driven by potential outliers that are influential observations. To detect such observations, I obtained the standardized residuals of all observations and excluded a few observations with standardized residuals

larger than 3 in absolute value. After rerunning the regression, the results did not change and therefore the regression model did not suffer from outliers.

Overall, the robust regression model has a good fit as demonstrated by the high R-squared value. Out of 162 observations, the regression shows that 86.1% of the variation in the adjusted hammer price is explained by the variation of the independent variables. Since the aforementioned Breusch-Pagan test established the presence of heteroscedasticity, the usage of robust standard error is quoted in parenthesis in order to be heteroscedasticity-consistent.

The model demonstrates a strong correlation between lot number and hammer price. The coefficient -7.050 shows the negative relationship between the order of which a Rothko is placed in auction and the hammer price. In other words, the auctioneer should expect a \$7,050 decrease in hammer price for every additional lot number increase for Rothko paintings, holding all else constant. Therefore, this result affirms the presence of declining price anomaly in previous academic studies. The underlying rationale behind this phenomenon is perhaps that the beginning of an auction usually draws the most attention, and some buyers may irrationally increase their bid as a result of excitement. However, bidders are more inclined to lose interest as auction drags on over time, and therefore the bidding competition and hammer price are suppressed toward the end of an auction. Another possible explanation for this effect is that auctioneers are already aware of the presence of the pricing anomaly, and therefore they intentionally organize the order of an auction in way such that expensive lots, including Rothko's work, are featured first.

Unlike previous studies, my model shows that neither age nor age squared are statistically significant factors in affecting hammer price. One possible explanation that age is not a critical factor is as a result of Rothko's career progression. Unlike previous studies which examine the entire life cycle and artistic output of Old Masters, my database is mostly focused on Rothko's abstract paintings which he created throughout his forties until his death at the age of 67. Although Rothko experimented with figurative paintings in his youth, he was mostly known for his abstract Color Field paintings. The auction market seem to strong favor these abstract paintings, as there are only a few records of his earlier career work which were omitted in my database. Therefore, age is not a pivotal factor because Rothko had already established his artistic reputation and style at this point.

Intriguingly, the regression model demonstrates that the size of the painting plays a significant role in auction price. The coefficient for size is 3,713, which suggests that Rothko's large scale abstract painting are highly desirable in the auction market. *Ceteris paribus*, a lot is expected to be sold \$3,712,883 more in auction for every square meter increase in size. In fact, the magnitude of the variable is quite substantial when compared to other statistically significant variables. This result is reasonable since the size of a Rothko painting is one of the most visually appealing elements that appeal to buyers. Rothko believed that a large canvas consisting of enriched tones amplifies the emotional, meditative experience when admiring his paintings, whereas a small-scale frame may not

be able to communicate the same emotion between the artist and the viewer. Therefore, the auction market places a strong emphasis on size when valuing Rothko's paintings.

Meanwhile, width is a statistically significant covariate that negatively impacts the hammer price. For every additional meter in width, a Rothko painting is expected to lose \$8,118,022 in hammer price holding all other factors constant. This suggests that the auction market seem to favor Rothko's vertical compositions over horizontal compositions. Rothko preferred to use vertical composition as the longitude of the canvas is associated with gravity and sublimity. Furthermore, Rothko specifically wanted his viewers to be enclosed in his painting and a horizontal canvas does not have the same immersion effect. Therefore, it is reasonable that the auction market penalizes additional width for abstract paintings.

In terms of artistic media, acrylic is a statistically significant variable that negatively impacts the hammer price. Holding all else constant, an acrylic painting is expected to decrease by \$2,633,818 in hammer price. This result suggests that oil is the preferred paint among Rothko's paintings. It is possible that oil paint contains more pigments and therefore allowing more vivid colors and richer tones in Rothko's paintings. Traditionally, oil has been used in paintings for hundred of years whereas acrylic paint was developed in mid-20th century. One of the main difference between the two is drying time – oil paint dries very slowly whereas acrylic can dry within an hour. The malleable, slow drying nature of oil allows the painter the deliberate and work on the artwork over a long period of time. It is possible oil is a more suitable medium for

Rothko's abstract, multiform paintings featuring layers of color, and therefore the auction market penalizes his acrylic paintings.

As expected, the pre-sale estimates are strongly correlated with hammer price as shown by the p-value less than 0.01. Considering that the estimates already price in essential factors that would potentially influence the hammer price, such as condition, provenance, medium, and historical importance, it is unsurprising that auction house specialist's valuation strongly corresponds with the actual market value. On the other hand, this result also shows that auction house experts tend to slightly underestimate the value of Rothko's paintings. Since obtaining the mean of the low and high estimates is the most intuitive method to measure the expected hammer price, we should expect a coefficient close to 1 if the experts' opinion were perfectly unbiased. That being said, the 1.161 coefficient shows the actual hammer price is slightly higher than the predicted value. Therefore, these estimates are slightly biased with a downward pricing tendency. One possible explanation behind this phenomenon is that it is always preferable to exceed expectation. If the painting were sold beyond predicted price, the consigner would be delighted that the lot performed well.

The model also shows that the auction location does not affect the hammer price. In this dataset, all Rothko paintings were auctioned either in London or New York. The binary variable "SoldinUS" is not statistically significant in any models. Considering that the art business operates in global market with buyers bidding over the phone from all over the world, it is unsurprising that geographic location does not affect a Rothko's

hammer price. If the same painting were valued differently across the Atlantic, speculators would be engaging in arbitrage and exploiting the market inefficiency.

Finally, it is critical to examine the effect of auction house on hammer price. Both Sotheby's and Christie's have positive coefficients, but neither were statistically significant. Since there are only three auction houses that have auctioned Rothko paintings in this dataset, "Phillips" is a perfect multicollinear dummy variable and thus omitted by Stata. I also omitted either "Sotheby's" or "Christie's" in other models, but none were statistically significant. This seems reasonable as these auction houses are equally prestigious and a potential client should expect the same auction results if he or she decides to auction a Rothko painting by any of them.

Conclusion

This thesis examines the factors that influence the hammer price of Mark Rothko's abstract painting in auction. The econometric analysis, using a newly constructed database of over 170 observations, determines that Rothko's hammer price is strongly correlated with art experts' pre-sale estimates, the lot number, width and the size of the artwork, and paint medium. The regression model affirms the previous academic discussion of declining price anomaly, or the negative relationship between selling order and hammer price in sequential auction. Unlike previous discussions, age is not a statistically significant factor in affecting Rothko's auction price. In addition, the model shows that auction house experts' estimates are mostly accurate but tend to slightly undervalue Rothko's paintings. The model also demonstrates that selling location and auction house do not affect hammer price. Furthermore, canvas orientation also matters as the width increase in Rothko's paintings penalizes hammer price. Finally, my thesis establishes the positive relationship between size and hammer price.

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